DOCUMENT RESUME

ED 477 088 IR 021 816

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TITLE	Information Technology Groupware: The Impact of Electronic Collaboration on Project Teams.
PUB DATE	2002-06-00
NOTE	7p.; In: ED-MEDIA 2002 World Conference on Educational Multimedia, Hypermedia & Telecommunications. Proceedings (14th, Denver, Colorado, June 24-29, 2002); see IR 021 687.
AVAILABLE FROM	Association for the Advancement of Computing in Education (AACE), P.O. Box 3728, Norfolk, VA 23514. Tel: 757-623-7588; e-mail: info@aace.org; Web site: http://www.aace.org/DL/.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	*Computer Mediated Communication; Cooperation; *Cooperative Learning; *Cooperative Programs; *Group Discussion; Information Technology; Student Reaction; *Teamwork
IDENTIFIERS	*Collaborative Learning; *Groupware

ABSTRACT

Team collaboration is an important part of working in business today. This study in electronic collaboration usage and implications extends what has already been done in groupware and group collaboration systems. The authors produced an experiment in which students were given the opportunity to use many different collaborative tools. A pre-test survey and post-test survey were used to evaluate the students' willingness to use collaborative tools. This paper describes the test, findings and ramifications. (Contains 10 references.) (Author/AEF)

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Information Technology Groupware: The Impact of Electronic Collaboration on Project Teams

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Abstract: Team collaboration is an important part of working in business today. We produced an experiment in which students were given the opportunity to use many different collaborative tools. We used a pre-test survey and post-test survey to evaluate the student's willingness to use collaborative tools. The paper describes the test, findings and ramifications.

Introduction:

Team collaboration is an important part of working in business today. Because teams are used often in business settings, universities require prospective business candidates to become exposed to collaboration through team projects. One type of collaboration that can be used in team settings is electronic. The purpose of this study is to show that electronic collaboration can impact students' frequency of technology usage as well as their acceptance to using collaborative technologies. Our first goal was to verify that students will use technology more often over time in project team settings after they have been exposed to both the technology and the actual team collaboration. Our second goal is to verify that students will find the technologies useful, thus increasing their acceptance of it, with certain features for group projects. Therefore, the student acceptance of using technology in team settings will increase as they become more acquainted with the tool and its features.

Several new tools have been designed to make teamwork and collaboration more efficient. These groupware programs can allow users to exchange files, draw collaborative sketches, and use auditory voicing along with providing many other features. These features are attractive to users who are highly involved in teams and collaboration. Furthermore, electronic collaboration is becoming more important in both academic and business settings. The benefits these technologies can offer to users will hopefully solve problems of distance, communication, sharing information, and costs.

This study in electronic collaboration usage and implications which extends what has already been done in groupware and group collaboration systems. Electronic collaboration holds promise for future studies in a variety of settings as technology continues to grow and becomes an even more integral part of culture throughout the world. The structure of this paper is presented in the following format: I. Introduction, II. Literature Review, III. Hypothesis Development, IV. Methodology, V. Data Analysis, VI. Research Results, and VII. Recommendations, and VIII. Further Studies.

Literature Review:

Information technology has had a revolutionary impact on society within the last several years. The recent growth of networks, cellular communications, and fiber optic cables have spawned the Internet boom and have provided opportunities for convergence with existing media such as television (Halal, 1992). This shows the trend of technology being converged into current social norms. Other examples include the Internet and teleconferencing as means to improving communication in office, school, and home settings (Halal, 1992). These instances further show the fact that technology is changing the way we live and work.

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The result of these trends shows that technology is a catalyst for defining our social domain. Consequently, the term "virtual community" formed to reflect how our culture acts toward technology; a virtual community is one where the people are able to communicate and interact in an online environment (Halal, 1992). Because of the heavy reliance on technology in our global society, people have a strong need for communication. Collaboration is one aspect which technology can advance in order to bring citizens in virtual communities closer together.

Collaboration is a term for actively communicating with other people. The benefits of effective collaboration can be highly favorable in work, academic, and personal settings (Chandra, 1996). This current term for communicating with the aid of technology is called electronic collaboration. There is a tremendous synergy that exists in an effective e-collaboration environment. The benefits from these virtual teams can solve many problems such as distance and schedule conflicts.

With the enhancements of team communication in business and academic environments, electronic collaboration can revolutionize the way people exchange information. For example, many businesses have integrated collaborative designs and opted toward a paperless environment. In addition to e-collaboration being an advantage, there are several types of electronic tools that offer unique features.

Electronic collaboration tools, also known as groupware contains a certain outline of functionality, which includes messaging, scheduling, and audio communication. There are also special capabilities of e-mail, including beeper triggering, which can be useful to individuals who carry pagers. Another type of e-collaboration is instant messaging. Three popular services, which provide instant messaging, are Yahoo, AOL, and MSN (Agnew, 2000). Instant messaging is a forum for real-time communication that can include text chat and audio transmission over the Internet. This real-time synergy allows individuals to communicate instantaneously with other users, unlike e-mail, which stores a record. Furthermore, text chat simulates person-to-person chatting while e-mail represents letter writing.

Additionally, there are other groupware products on the market that incorporate several features into one package. Among these tools are Blackboard, Stuffincommon, Centranow, Webex, Placeware, Blink, Backflip, Groove, and Lotus Notes. These e-collaboration tools each have their own unique features. One feature is known as an electronic calendar (Agnew, 2000). This can allow one to schedule and plan activities online. Other important features of e-collaboration tools include notification of users online and file download capabilities. These abilities can let someone know when a team member is online. Furthermore, the ability to download and upload files is a tremendous advantage to exchanging information.

Several popular groupware packages, such as Groove, Lotus Notes, and E-Room, allow users to utilize one program for many features (Fontana, 2001). Some of these features include threaded discussion and file sharing across the Internet. Furthermore, bookmarks, post-it notes, and white boards also allow users to post and store information online. Bookmarks are useful for saving links to other websites while post-its can act as reminders for information. Also, whiteboards are a popular feature that allows users to interact real-time and draw (Fontana, 2001). Though e-collaboration features are very important for user-specific tasks, the benefits from those features are far more significant. Another important benefit is the improved flow of communication between users (McDougall, 2000). This peer-to-peer advantage can increase the effectiveness of online collaboration by minimizing interruptions and system lock-downs.

Flexibility, navigation, and control are very important when using software packages (Borck, 2000). These benefits allow the system to adapt to the user and promote usability. Other advantages of using groupware include convenience, accessibility and user-friendly interfaces. If a collaboration tool is fast, easy to use, easy to learn, and visually appealing, individuals will more likely be willing to use the program. Also, timing and costs are important considerations (Darrow, 1997). Collaboration tools that save users time, allow them to work over distant geographic boundaries, and save costs, can be tremendous benefits to users in work as well as academic settings for team projects.

Another important aspect of electronic collaboration is its usage by individuals in team settings. The term usage refers to the frequency of an e-collaboration tool or how often it was used. The frequency of use indicates the number of times a user employs or activates an

electronic collaboration tool or one of its features. If a user increases his frequency of usage, he is more likely to become more dependent on the collaboration tool.

In addition to frequency, usage can also be referred to by effectiveness. For instance, if a user sees a purpose in using an e-collaboration tool, he is more likely to use it. This shows that the tool has been effective in providing a feature to the user for intended use. The variables that mainly affect this acceptance in use include level of experience using the product, level of tool exposure, and ease of use (Agarwal, 2000). If a user has had more experience using a product or has had a significant level of exposure to it, he may be more willing to use it, thus, increasing his acceptance of the product. Acceptance refers to the opposite of resistance, as it is used in an organizational or institutional setting (Ishii, 1999). For example, many users resist change from an old product to a new one. If a user sees a purpose for using an e-collaboration tool or feature, he may increase his level of usage.

Hypothesis Development:

Within this study, all subject matter is written in terms of class or group project teams. With this in mind, we will proceed to the hypothesis development. There are several variables in this study that require hypothesis testing in order to generate conclusions.

In this study, an analysis of the electronic collaboration affects on students in work teams and their implications was provided. The first objective was to measure how often students use a particular technology over **time** in the context of a team setting. The variables measured for this objective include the number of occurrences or times using a particular technology as well as the average time spent using a technology in one session. The arguments presented above form the following hypothesis:

H1: The frequency of technology usage by experienced students after two weeks using the tool in a team setting will increase

The second objective in this study was to measure student preferences on collaboration tool features as well as the benefits that can be derived from them. The variables measured for this objective include the level of importance of a particular technology feature as well as the level of usage while working on team projects over a two-week time frame. These arguments present the following hypothesis:

H2: The usefulness and acceptance of technologies by experienced students after two weeks using the tool in a team setting will increase

Methodology:

The methodology of this study is a progressive test experiment that compares sets of data over a period of time. The design of the experiment began with a pilot test consisting of a survey targeting college students. The pilot was given to approximately 10 candidates who were upper level information systems students.

The next step of the study was to survey a set of students. The set consisted of two classes; these were upper level and graduate students. Although there were 75 original subjects, only 38 subjects were usable. There were actually three separate surveys given to each student throughout the semester. The first survey obtained general background information on each subject and was given in the middle of the semester. The second and third surveys were given two weeks apart toward the end of the semester.

Throughout the experiment, the students were given the opportunity to use several e-collaboration tools including e-mail, instant messaging, and peer-to-peer tools including Blackboard and Groove; they were encouraged to use these tools for their team projects throughout the semester. The surveys were posted online through a university server. This allowed the users to complete the surveys at convenient times.

Data Analysis:

After the data was collected, we performed data analysis to determine if there was a statistical significance in the responses sent via electronic surveys.

For this survey there were several variables analyzed primarily to describe background data about the subjects. This included the variables gender, age, year in school, and location of address.

The first hypothesis to measure frequency of technology usage was tested using several variables for different collaboration types: email, instant messaging, Blackboard, and peer-to-peer groupware. These variables were compared from survey two to survey three after two weeks of student interaction in teams. For each of these five variables, the amount of times used in the past two weeks was also included.

Finally, the second hypothesis to measure the usefulness and increase in importance or acceptance for online collaboration was tested. Comparing survey two and survey three in terms of the features and benefits did this. There were a total of 11 feature variables and 14 benefit variables measured in this study.

Research Results:

After the data was analyzed, the results of the research project were reported in order to deduce outcomes and generate conclusions. In terms of experience in team environments, all users stated they had opportunities to work in those settings. The average amount of team projects students have had in the last year was between five and seven. Also, teams mostly met at the campus library on evenings in person. The majority of subjects claimed to exchange information online through email, as opposed to instant messaging and other more complex groupware packages. Instead of meeting online for team project collaboration, they normally shared information electronically.

H1: The frequency of technology usage by experienced students after two weeks using the tool in a team setting will increase

The usage of instant messaging slightly declined over two weeks. This could be a result of students meeting physically in their teams more often than electronically.

There is no significant difference in the amount of time spent per session using e-mail as opposed to instant messaging. Hypothesis 1 is not supported due to the decline in the means. The decline in email usage over the two-week period could be a result of team members exchanging more files in one setting. Also, only a few members of each team may have been responsible for updating the other members and sending files through email.

Third, results for the groupware, Blackboard, demonstrated a decline in frequency of usage. The means for this variable are distinct; Hypothesis 1 is not supported due to the decline in the means. This shows that there was actually a decrease in the frequency of technology usage for Blackboard. This decrease is mostly a result of a disruption in class meeting times from Thanksgiving break (see Further Study). Also, the number of class assignments requiring students to access Blackboard had decreased before the Thanksgiving break.

Finally, students were tested on their usage of their two most preferred groupware programs. However, the majority of students did not have a preference for using a groupware collaboration tool, nor did they spend time using them during their group activities. This was the case before the study as well as after the two-week test.

H2: The usefulness and acceptance of technologies by experienced students after two weeks using the tool in a team setting will increase

First, the variable for the collaboration feature real-time voice was tested. Initially, students believed that real-time voice was an average concern. It was rated 3 on a scale of 1 to 7, where 7 is the highest rating. However, after the experiment, preference for voice changed to a rating of two. This shows that students did not see much of a purpose for using real-time voice with in their teams. In addition to voice, real-time text messaging had also slightly decreased in level of importance. Initially, students rated real-time messaging as highly important at level six. However, after the study, students rated real-time text chat at level of 5.6. Although this change represents a slight decline for text chat, students generally use this feature and find it important. Students' initial perceptions of these features were slightly higher than their actual level of use during the two-week

experiment. The drop in voice usage could have been a result of restrictions requiring students to keep a low voice volume when working in the computer labs.

The next set of features that represented a significant decline in preference, were file download capabilities and Internet file sharing. Initially, file download capabilities and file sharing were rated at 6.5 and 5.7 respectively. However, after two weeks, the two features were rated at 5 and 4.6 respectively. This shows that within the two-week experiment, most users did not use these capabilities as much as they initially did.

Another less commonly used feature was the online calendar. This variable was initially given a rating of 5.1 out of 7. However, after two weeks, users decreased their level of importance rating to 2.4. This shows that students did not have a need for collaboration tool calendars through out the span of their project.

Also, one last feature was the ability to notify others online. Before the experiment, students had a preference of 5.8 out of 7 for this feature. After the two-week time period, students rated online notification at the range of 5.5. This shows that there was no significant change in this variable. Therefore, online notification is still considered moderately important to students.

In addition to feature ratings, students were also tested on whether they saw a benefit from using electronic collaboration tools. Initially, students rated the importance of control, access, and convenience in the range of 6.4. After two weeks of working with collaboration tools, their preferences for these three benefits changed to a range of 6.2 out of 7. Though there was a slight drop in the means between the beginning and end of the experiment, the ratings were very high at both times, which supports Hypothesis 2. Because users rated these benefits above 6 both before and after the study, they believed the benefits were useful, thus increasing their acceptance of the tools.

The next set of benefits that had a slightly higher decline in preferences included flexibility, information flow, navigation, and security. Originally, students rated these benefits in the range of 6.2 out of 7. After two weeks, these students changed their preferences to approximately 5.8. Although there was a slight drop, users generally find these benefits important. However, they may not be as important as they were before the study.

The next two benefits with similar initial preferences were the speed and the user-friendly interface of the collaboration tool, which were initially rated at 6.3. After the short two-week time period ended, students rated these features at approximately 6.1. This shows that students still find system speed and ease of use to be very important despite the fact that preferences dropped slightly. The student rankings were above 6 on the 7-point scale both before and after the experiment. This supports Hypothesis 2, because students believed the benefits from fast and easy usage were useful, which increased their acceptance of the tools.

In terms of features available, users do not have much of a preference for the number of options that one groupware package can offer. This was shown by the decline in the means from 5.2 to 4.7 for the importance of feature quantity in e-collaboration tools.

One final set of benefits that users rated included the ability to save time, travel, and costs. Despite a slight decline, students believe that the benefit from time savings when using e-collaboration tools are very high, which supports Hypothesis 2; the benefit was found useful for students and has increased their awareness and acceptance of the technologies.

In summary, students generally rate certain features of collaboration tools more important then others. For example, real text messaging, online notification, and file download capabilities were the most used over the span of two weeks within their team projects. This shows that students see a purpose or importance to using electronic collaboration tools, such as e-mail and instant messaging, which contain these features. Users ranked the importance for convenience, easy access, control, user-friendly environment, speed, and time and distance-savings as the most important. Although the importance of these benefits has not significantly changed over the two-week time period, students have continued to rank their usefulness high. This supports Hypothesis 2, because receiving a benefit from technology is considered very important to students; therefore, their acceptance of the technologies has increased as a result of them using the tools to collaborate.

Recommendation:

After analyzing the results of this study, we have proposed a few recommendations. Hypothesis 1 was not supported; It is suggested that facilitators increase the level of e-tool exposure and requirements for their students in order for them to gain experience using a multitude of electronic collaboration features. By making it a requirement for students to study and learn the wide variety of collaboration features available, students would then be more educated and informed about using an e-collaboration tool.

In contrast to the first hypothesis, Hypothesis 2 was supported; students found several electronic collaboration features necessary for communicating in virtual environments. Thus, they saw a purpose for using e-collaboration tools and should be willing to use these tools for projects in the future. I suggest that students should have many teachers promote electronic collaboration environments for classroom use in order to positively reinforce the benefits from these tools.

Further Study:

In addition to this project, there are several possible extensions for consideration when doing further research. For example, time was a very important factor in the completion of this experiment. If more time can be allocated between survey instruments, then the accuracy of the comparisons would improve. Also, the time restriction in this study brought several constraints to the subjects of the experiment who actually used technology. In addition to timing, another consideration for further research was related to the actual subjects. For instance, in this study, many of the student subjects were majoring in academic curriculums that focused on technology, such as information systems. By expanding the subjects by area of expertise and experience, the external validity of this research could proxy for a wider distribution of student academic curriculums.

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